BB2470 Genetics and Genomics 10.0 credits

Genetik och genomik

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for BB2470 valid from Autumn 2011

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Biotechnology

Specific prerequisites

At least 150 credits from grades 1, 2 and 3 of which at least 100 credits from years 1 and 2, and bachelor's work must be completed. The 150 credits should include a minimum of 20 credits within the fields of Mathematics, Numerical Analysis and Computer Sciences, 5 of these must be within the fields of Numerical Analysis and Computer Sciences, 20 credits of Chemistry, possibly including courses in Chemical Measuring Techniques and 20 credits of Biotechnology or Molecular Biology.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

Part one

Following completion and passing the course you should be able to describe:

¨ the architecture and function of the genomes of the different organisms, and explain how differences and similarities have evolved since the origins of life

¨ how genes function and are inherited in different types of organisms, and how this affects the organisms' function and defence against genetic defects, and their evolution

¨ how DNA gets damaged and is repaired in the cells, and how genetic variation, resulting from inheritance or from "fresh" DNA damage, affects our health

¨ how genetic variation, among genes, individuals, populations or species, originates and evolves

Part two

Following completion and passing the course you should be able to:

I. Describe, illustrate and relate different techniques in the fields of genomics and transcriptomics

II. Critically evaluate, select and apply the most appropriate technique(s) in different biological and medical studies.

III. Discuss and suggest strategies to tackle and solve challenging problems in various research studies.

IV. Construct and create biologically relevant studies by employing one or more of the discussed tools.

Course contents

Part one

Genetics is the basis for most biological, medical and biotechnical analyses and techniques. Consequently, in order to optimally exploit the biotechnical tools, knowledge about the basic genetics is of great importance. This part of the course aims to give a broad knowledge, from an evolutionary perspective, of how genetic variation is formed and inherited, and how it evolves.

A number of basic aspects of genetics will be studied, for example:

The origins of life, and the "Tree of Life": the origins, development and relationships (phylogeny) of all organisms

The mechanisms of evolution

The genetic difference between organisms: differences and similarities in the architecture and function of the genomes, and how this evolved through the evolution

Inheritance of genes and traits: different modes of inheritance (e.g. Mendelian and asexual) and their effect on the "success" of individuals and species

Inherited diseases: their causes and effects

Mutations: the chemistry of DNA damage, the types of mutations, and cellular mechanisms for their repair

Mapping of genes (identification of which trait is affected by which gene)

Genetic differences between human populations: their historical origin and subsequent spread, and their medical importance

Course content: Part two

This part of the course aims to give detailed insight into the techniques and technological trends in the fields of genomics and transcriptomics, to build up the necessary foundations for further understanding of association studies, pharmacogenomics, forensics, population genetics, diagnostics, medicine and drug development. The course includes a short introduction to conventional assays used in molecular biotechnology, description of different methods for typing of genetic variations, a variety of techniques for multiplex amplification, advanced techniques and platforms for DNA sequencing and whole genome sequencing, and different techniques for transcript profiling.

In addition, the course involves a literature workshop of selected articles, which will be performed in groups. Each group presents one article and will oppose two other groups' articles. This project aims to learn critical reading, interpretation and comparison of the most advanced techniques and platforms in the fields of whole genome sequencing, massive parallel genotyping and transcript profiling. The project requires teamwork and planning, and participation as well as presence on the workshop days is compulsory. The course also includes assignments that should be prepared after each lecture.

Course literature

Part one

Course book: ”Fundamental Genetics” by John Ringo Cambridge University Press 2004

Additional texts: Eleven articles – Reviews, popular science, and book chapters.

Part two

Distributed handouts and articles.

Examination

- PRO1 - Project, 1.0 credits, grading scale: P, F
- TEN1 - Written exam, 4.5 credits, grading scale: A, B, C, D, E, FX, F
- TEN2 - Written exam, 4.5 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH’s coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Part one

Written exam (TEN1, 4.5 hp, grade scale A-F).

Account of the additional texts.

Part two

The examination will be based on: Lectures, Handouts and Distributed articles. The written examination will have short essay type of questions (TEN2, 4.5 hp, grade scale A-F).

Project PRO1 (P/F): The project requires teamwork and planning, and participation as well as presence on the workshop days (October 5, 12, 14 and 16) is compulsory.

Other requirements for final grade

Passing grade on all four parts. Active participation in the literature projects, assignments and written examination.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.